2008 Presidential Address

"Geography of Opportunity": Poverty, Place, and Educational Outcomes

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This article is an expanded version of the 2008 American Educational Research Association's Presidential Address. The purpose of the article is to describe the geography of opportunity in two metropolitan regions of the United States that are engaged in significant efforts to transform their local political economies. Both metropolitan regions have invested substantive resources into the development of an area of industrial science—one in telecommunications, one in biotechnology. A central underlying question in this article is, How does geography influence opportunity? The article's two case studies investigate this question, using different methodological approaches. The article concludes with two important lessons learned from the research.

Keywords: cities; policy; science education; social stratification; urban education

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> The risks posed by the uneven geography of opportunity, not to mention the challenges associated with changing it, are all but invisible on the public agenda as well as in the nation's intellectual life.
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> –Briggs, 2005, p. 5[1]

It is generally assumed that attempts to advance science and related industries in a city or metropolitan region are a positive development for a broad expanse of the community. The purpose of this article is to explore that assumption. It is our civic responsibility as scholars to question an assumption of this import. The term *civic* is borrowed from the Latin *cīvicus*—of or for a citizen. The etymology of the word includes a Latin-to-English derivation referring to the Roman civic crown (Barnhart, 1988/1995). The civic crown was awarded to the individual who saved the life of a fellow citizen in battle. Similarly, the rise of statistical thinking in the social sciences is associated with doing research on or for citizens out of concern for protecting their lives (Porter, 1986).

The notion of research on citizens or for citizens has a long history in the United States and abroad. There are substantive research literatures focused on civic progress in areas such as health, housing, transportation, and education (e.g., Briggs, 2005; Dye, 2008; Heaney & Uchitelle, 2004; Rusk, 2003; Yeakey & Henderson, 2003). Science also has made important contributions to many areas of consequence for the public, including pharmacology, transportation, law enforcement, national security, and space technology (Couzin, 2005; Jenkins & Burton, 2008; Kerr, 2004). It is not the intent here to call into question the extensive contributions that science has made to the advancement of society. Nor is it the goal to discuss the inappropriate actions by some individuals and institutions in the name of science (E. Black, 2003; Washington, 2006). Public–private partnerships drawing on significant social capital and financial resources compete for science and related industry as a matter of civic responsibility (Hanson, 2003; Judd & Swanstrom, 2008). Investment in research science is viewed by some as a public good (Thompson, Yücel, & Duca, 2002). The theme of science and civic responsibility drives quests for many forms of public support, such as housing subsidies for engineers and scientists, stem cell funding initiatives, tax incremental financing, highway and residential development, and eminent domain (Paugh & Lafance, 1997; Spaulding & Slye Colliers International, 2005).[2] Yet, as social scientists, we should seek to better understand what Yeakey (2000) referred to as "structured silences" (p. 290). Our theories and methods may limit our ability to hear the voices and document the experiences of traditionally underserved children and families. In most discussions about science and metropolitan America, the risks of uneven geography of opportunity are largely omitted. Evaluation of the geography of opportunity in metropolitan America includes the study of patterns of development where the fortunes of cities and suburbs are explored in tandem (Briggs, 2005).

We live in a society where evaluation has played an increasing role in matters of state (Cohen, 1982; Faigman, 2004; Greenberg & Shroder, 2004; Porter, 1986).[3] As a result of ideological commitments to social evaluation and reform, our education research community has a civic responsibility to better understand how science and related industries influence the geography of opportunity in our cities and metropolitan regions. More important, it is critical that factors associated with human development and opportunity be salient features of the evaluative process.

The remarks that follow are organized into two case studies. First, I will present the Dallas Metroplex case study,

Educational Researcher, Vol. 37, No. 7, pp. 397–411
DOI: 10.3102/0013189X08326409

which provides insights into the geography of opportunity through the eyes of a group of middle school students. The methods for this case study were formulated to give voice to the lives and experiences of children in a traditionally underserved community. A particular focus will be on the geography of opportunity. I will follow a strategy outlined in two ongoing research and development projects sponsored by the National Cancer Institute and the Centers for Disease Control, where scientists are attempting to integrate empirically based research findings into stories to better communicate the implications of science in matters of public health (Bernhard, 2008).

Next, I will describe the metropolitan St. Louis case study. This study uses an ecological approach to analyze the geography of opportunity in the region. It explores the interrelationships of industrial science, employment, and education, with a particular focus on the spatial nature of the interactions.

The two case studies differ methodologically. However, the goal is to present contrasting perspectives and analytical approaches. Aristotle remarked, "Some people do not listen to a speaker unless he speaks mathematically, others unless he gives instances, while others expect him to cite a poet as witness" (350 B.C.E., Book II, Part 3). All three methods will be incorporated into this article.

The Dallas Metroplex Case Study

The Texas telecommunications research and development industry is important and deeply entrenched in North Dallas and southern Collin County (e.g., in Plano and Richardson). The term *telecommunication* is a compound word borrowed from the Greek *tele,* meaning "far, far off, operating over a long distance," and the Latin *communicare,* meaning "to partake in common, to share" (Barnhart, 1988/1995, pp. 143, 799). The history of telecommunications has included the use of flags, drums, smoke signals, and the telegraph. Modern telecommunications is the science and technology of using electronic transmitters to send encoded sound, pictures, or data over long distances in the form of electromagnetic waves (Marven & Ewers, 1996; McClellan, Schafer, & Yoder, 1998; Orsak et al., 2004). This is possible because analog signals, such as sound, can be converted into numbers through a sampling process. Sampling of a waveform consists of taking measurements of the signal at regularly spaced intervals. A critical question in the field of information theory was how fast the measurements should be taken to ensure that the list of numbers accurately reflects the original signal. This question of appropriate sampling rate is a major issue in modern telecommunications. One of the mathematical advances contributing to the resolution of this question is a foundational mathematical result called the Nyquist sampling theorem, named after Harry Nyquist, a Bell Laboratories engineer and physicist (Orsak et al., 2004).[4] The theorem, stated in simple terms, is as follows: To convert a sampled signal back to its original analog signal without error requires a sampling rate that is more than twice the maximum frequency of the signal. The implications of the Nyquist sampling theorem are far reaching.

Time does not permit even a concise treatment of the mathematical foundation of telecommunications science. Instead, my intention here is to describe how the science of telecommunications has informed the development of a significant industry. More specifically, I will focus on how this industry has influenced the geography of opportunity in metropolitan Dallas. How widespread is telecommunications as an industry? The U.S. Central Intelligence Agency (2008) reported that worldwide in 2005 there were more than 1.26 billion telephone mainlines in use, 2.16 billion mobile cellular subscribers, and 1.01 billion Internet users. According to an estimate by the Insight Research Corporation (2007), the worldwide revenue in telecommunications will grow from $1.7 trillion in 2008 to more than $2.7 trillion in 2013. To better understand the significance of this projected growth, it is useful to have some background information related to gross world product. The Central Intelligence Agency (2008) estimates that the 2007 gross world product was $65.82 trillion. The potential for additional growth in the telecommunications industry remains very positive.

The fastest growing telecommunications markets are in the Caribbean, Latin America, and Asia. Telecommunications products are too numerous to list. In addition, per Moore's law, the telecommunications industry will continue to have opportunities for both original product development and improved versions of existing products. Gordon E. Moore, Intel cofounder, theorized that the number of transistors on an integrated circuit will double approximately every 2 years. In theory, the computing powers of integrated circuits will double every 2 years (Orsak et al., 2004). Enhanced computing power helps make it feasible to develop new telecommunications-related products. In response, many metropolitan regions organize to support and advance the production and distribution of the latest innovations in the field of telecommunications.

The Telecom Corridor in metropolitan Dallas includes many corporations and partnerships that contribute to the development of telecommunications product lines. But the area has a great deal more than product development to offer. Let me share a personal journey traveled 15 years ago through the Telecom Corridor to South Dallas. Starting in Plano, Texas, I drove south on I-75, more commonly known as the North Central Expressway. The technology industry was evident everywhere. Traffic was moving slowly, so I glanced to my left, and in full view was the corporate park of Texas Instruments, the bellwether of the telecommunications industry in this community. Texas Instruments moved in the late 1950s to this part of North Texas, which was thereafter transformed by a massive clustering of multinational technology companies, including Nortel, Ericsson, Alcatel-Lucent, Tellabs, and AT&T. Scores of technology companies are located in the corridor today. The Telecom Corridor is part of a larger metropolitan economy. According to the Greater Dallas Chamber of Commerce (2006), the 2004 Dallas–Fort Worth local economy was estimated to have generated a real gross regional product of $254 billion. If the region were a country, it would rank 19th in the world in gross domestic product, between Switzerland and Belgium.

Texas Instruments' leadership recognized that higher education is an important partner in a developing regional technology hub. When the company moved to the region, there was no research university there. To attract scientists, engineers, and other creative talent, it had to recruit in other parts of the country. Realizing that growing the industry in the region would require a high-quality academic environment, in 1961 the company established the Graduate Research Center of the Southwest, later renamed the Southwest Center for Advanced Studies (University of Texas–Dallas, 2008).

Many outstanding scientists participated in the center's work. Ultimately, Texas Instruments donated the center and its land to the University of Texas system. This is how the University of Texas–Dallas (UTD) was established. The center's scientists provided a research infrastructure to advance the specialized mission of the university in science, engineering, and management. Today, UTD is a major contributor to research and human resource development efforts in the Telecom Corridor. According to McKinley et al. (2005), UTD graduated 3,240 people in 2003–2004, awarding 1,823 bachelor's, 1,363 master's, and 50 doctoral degrees. The total number enrolled in fall 2004 was 14,092. The UTD Jonsson School is reported to be one of the fastest growing engineering schools in the United States and ranks second nationally in the annual production of computer science degree recipients. In addition, in FY2004, the university's economic impact amounted to more than $348 million (in operational and capital expenditures and the expenditures of faculty, staff, and nonresidents) and more than 6,000 jobs (McKinley et al., 2005).

As I continued south on the North Central Expressway, my journey was slowed by the steady traffic. Today this would not be the same challenge. In 1996, Dallas Area Rapid Transit opened the Red Line, a light rail train service. The line runs northeast from the intersection of Lamar Street and Memorial Drive, under the Dallas Convention Center and through downtown, then follows the Central Expressway through North Dallas, Richardson, and Plano, linking the center of town to the Telecom Corridor (Dallas Area Rapid Transit, 2008). Now thousands of knowledge workers can commute in and out of the corridor. The areas contiguous to the North Central Expressway from Plano to downtown Dallas consist of many high-income neighborhoods and enclave cities such as Highland Park and University Park. According to a 2007 CNNMoney report, Highland Park has a population of approximately 8,900. The median family income is more than $370,000, and the median home price is $1.6 million. The estimated population of University Park is 24,700. Its median family income is $162,282; the median home price is more than $1 million.

The capital investment and human resources associated with organizations along the North Central Expressway are significant. For example, the late Ray Nasher's North Park Mall, one of the first enclosed shopping centers in the United States, is adjacent to the North Central Expressway at Park Lane. Ray Nasher was a major real estate developer. During the 1960s, he served in President Lyndon Johnson's administration. Nasher chaired the National Commission of Urban Development in 1964–1965 and was a U.S. delegate to the General Assembly of the United Nations in 1967–1968 (Kutner, 2007). More than just a mall, North Park is a cultural center, decorated with modern sculptures from Nasher's significant collection. Plans are in place to open a public library in the structure.

The traffic congestion broke suddenly at Mockingbird Lane and the North Central Expressway. This is the exit for Southern Methodist University. According to the *Chronicle of Higher Education* ("Compensation of Presidents," 2007), Southern Methodist reported 2005–2006 expenditures of $388 million and revenues of $488 million. The university has a long tradition of producing regional leaders in the business and legal communities. More recently, it has made significant contributions to engineering education (see Tate, 2001; Tate & Malancharuvil-Berkes, 2006). With an endowment exceeding $1 billion and a board of trustees that includes U.S. First Lady Laura Bush, Ross Perot Jr., Texas Instruments Chairman Thomas Engibous, Ray L. Hunt of Hunt Oil Company, and other leading corporate and civic leaders (Southern Methodist University, 2006), the university is an important regional asset.

My trip continued. As I passed downtown and headed southeast on the South Central Expressway, the scene became very different. I exited on Pennsylvania Avenue. Heading east to Martin Luther King Drive, I turned left. On the horizon, I saw Fair Park, home of the Cotton Bowl Stadium. The stadium is a historic reminder of the transformed local political economy. Dallas was once a transportation hub for cotton and other raw materials, then a cotton exchange and wholesale center for other goods (Hanson, 2003). As a result of the influx of goods and services, a significant banking and insurance industry emerged. Local banks supported the advancement of oil production in eastern Texas; for example, the Hunt Oil Company was launched. The oil industry attracted Geophysical Services Inc., a manufacturer of seismic and other exploration equipment. The firm changed its name to Texas Instruments.

Martin Luther King Drive was abuzz with patrons of small businesses—fast-food establishments, hair care storefronts, convenience stores, and the like. I entered my destination and saw the *Dallas Examiner,* a newspaper indigenous to South Dallas. That day's edition—February 25, 1993—featured a front-page cartoon caricature of Marvin Edwards, superintendent of the Dallas Independent School District, juggling five labeled balls: "instructional management," "student achievement," "unitary status," "district administrative improvement," and "board members." In the background were corporate and civic leaders with worried looks and the question "Can he keep it up?" Next I locked into the article titled "P. C. Anderson Students Try Hand at Problem Solving" (Robinson, 1993). The story was about geography of opportunity, poverty, and education. A group of students identified 25 problems they felt were negatively influencing their community, including the 13 liquor stores within a 1,000-foot radius of their South Dallas school. The students documented the negative influence of the stores on their school experience with precision and detail (Tate, 1994).

The students' research is complemented by that of professional researchers in the social sciences. For example, Airhihenbuwa and Liburd (2006) reported that predominately African American communities have more fast-food restaurants and vendors of alcoholic beverages per capita than White communities do. Moreover, African American consumers are targeted for importunate sales promotions of these products. The dearth of major grocery chains, farmers' markets, and whole-food markets in resource-poor African American neighborhoods has resulted in fewer affordable sources of fresh fruits and vegetables. These geographic characteristics are a concern for education researchers because quality nutrition is linked to the cognitive development of children (M. M. Black, 2003; Gorman, 1995; Richardson, 2003). In 1998, the Center on Hunger and Poverty at Brandeis University released the following statement:

> Undernutrition harms children silently. Even before it is severe and its results are readily detectable, inadequate food intake limits the ability of children to learn about the world around them.

When children are chronically undernourished their bodies conserve the limited food energy available. Energy is first reserved for maintenance of critical organ function, second for growth, and last for social activity and cognitive development. As a result, undernourished children decrease their activity levels and become more apathetic. This in turn affects their social interactions, inquisitiveness, and overall cognitive functioning. (Brandeis University, Center on Hunger and Poverty, 1998, Introduction)

In addition, neuroscientists hypothesize that brain development is negatively altered by the environmental conditions associated with poverty (Farah et al., 2006). Because poverty in cities generally is concentrated, this emerging research in neuroscience may well inform research associated with neighborhoods and education-related processes. Neighborhood conditions have been linked to the college aspirations of African American children. Stewart and colleagues (Stewart, Stewart, & Simons, 2007) found that living in a disadvantaged and resource-poor neighborhood is a negative influence on the college aspirations of African American students, above and beyond individual-level attributes and neighborhood controls. Goldring and coauthors (Goldring, Cohen-Vogel, Smrekar, & Taylor, 2006) noted that, in theory, neighborhood schools are expected to improve community attachment to schools, incentivize resource sharing, and enhance parent involvement and social capital. Their study makes an important contribution in finding that geographic proximity of school and neighborhood does not necessarily result in functional community support structures for children. Moreover, as desegregation orders and related remedies are eliminated, African American youth are being reassigned to schools in high-risk neighborhoods.

It is clear that the Pearl C. Anderson students identified a research problem with far-reaching social, political, and ethical implications. Problem identification was their initial step. They then designed a research project to better understand the nature and quality of the neighborhood surrounding each middle school in the school district (S. Mason, personal communication, May 25, 1994).[5] One of their research questions was, "Do other middle schools in the school district have liquor stores within a 1,000-foot radius of the school building?" Their findings indicated that their school was indeed unique in this respect among middle schools in the district. Moreover, the students discovered that their South Dallas neighborhood was zoned to permit this unhealthy condition. Over a period of 2 academic years, the students met with the city attorney (1 time), store owners (1 time), and individuals from the following organizations: Dallas City Council (2 times), Dallas Planning Commission (2 times), Dallas Independent School District School Board (2 times), Dallas County Commissioners Court (2 times), radio news station (2 times), print news media (2 times), Texas Alcohol and Beverage Commission Board (3 times), television news station (3 times), state legislature (5 times), and police department (6 times).

The editors of the *Dallas Morning News* took note:

[The students'] message and statistics hardly can be debated. There are at least 13 places that sell alcoholic beverages within a three-block stretch of Second Avenue, adjacent to [Pearl C.] Anderson Learning Center. One of the liquor stores is so close that it actually abuts the schoolyard. Students often find broken liquor bottles scattered across the playground when they come to school in the mornings. . . . Unfortunately, a legislative bill that prohibits alcoholic beverage consumption within 600 feet of a school has not been very helpful to the students. The bill requires that the distance be determined by measuring from the door of Pearl C. Anderson, which is in the middle of the school building on Garden Lane, to the nearest liquor store on Second Avenue. That means several hundred feet of school property must be crossed as part of the measurement. . . . The courageous efforts of the [Pearl C.] Anderson students have attracted national publicity. . . . But [the students] may not be able to succeed by themselves. It is time for people with experience and influence to join their cause. ("Students' Challenge," 1993)

The newspaper editorial called for a civic response to the students' research. What happened as a result of the students' research and sharing of information with government officials and media? One result was that the students' research and policy analysis were submitted to a state-level problem-solving competition. The students won the competition (S. Mason, personal communication, May 25, 1994). After nearly 15 years, however, how does the school's situation with regard to neighborhood liquor stores compare with those of other district middle schools? I decided to conduct a partial replication of the students' original problem-solving effort. Pearl C. Anderson Middle School and two other district middle schools were included. Highlights of the replication process are presented in a video that can be accessed with the electronic version of this article on the *Educational Researcher* website (http://er.aera.net).[6]

As you can observe, very little has changed in the Pearl C. Anderson neighborhood. The liquor stores continue to surround the school grounds. Who will answer the call to resolve this problem? Despite the impressive advances of the telecommunications industry in the region, opportunity is "far, far off" for the children in this South Dallas neighborhood. They do not share or "partake in common" in the kind of school–community experience to be found closer to the Telecom Corridor. The liquor stores are still present. Why? It is not possible to answer this question directly. However, research on metropolitan areas in the United States and specifically on metropolitan Dallas provide the basis for constructing a set of plausible responses.

One conceivable explanation can be gleaned from the scholarship of regime theorists in political science, who theorize that governmental authority is necessary but not adequate to advance and achieve public policy goals. Regime theory suggests, without embracing a position of economic determinism, that privately controlled investment is important to the advancement of public policy. The arrangements that develop between governmental authority and the private sector are key to public policy formation. According to Stone (1993), "A regime, whether national or local, is a set of arrangements by which this division of labor is bridged" (p. 2). In a study of the civic culture and governing structure of Dallas, Hanson (2003) characterized the city as an entrepreneurial regime where an elite business class controlled the civic agenda, distributed civic resources, and justified its sway through the civic culture that it organized. This influence was brought to bear through the Dallas Citizens Council, the council–manager city government, and the city's major newspaper. For much of the 20th century, the regime consisted of a

racially homogeneous group of home-grown business elites whose financial interests were connected largely to Dallas. This interlocked coalition fused the economic and political systems of Dallas. It controlled the governance of the city and of the school district (Linden, 1995). The entrepreneurial regime helped to foster a system of governance designed to limit electoral mobilization and widespread political participation (Hanson, 2003). Moreover, civic dialogue and sharing of responsibility for the leadership's policy choices have been rare.

The general lack of civic dialogue was coupled with the city government's lack of institutionalized analytical capability and related capacity. In addition, there was no significant investment by the city to advance effective urban planning or capital programming. Hanson (2003) argued that in Dallas, "consensus is facilitated by the absence of information or analysis that raises fundamental challenges to the agreed upon single option, thus restricting the range of likely disagreement" (p. 227). The students of Pearl C. Anderson engaged in an evaluative policy exercise related to human development, a practice inconsistent with the political culture fostered by the development regime of the city. The disconnect between sound developmental science and regional development is a theme that I will explore later in this article.

The long-standing stable influences of the Dallas entrepreneurial regime have lessened as its members age and withdraw from politics, and the corporate leadership now is less likely to consist of home-grown entrepreneurs (Hanson, 2003). In their place, the region has a new and ever-changing set of corporate leaders who head multinational corporations. This group has less interest in the development of the central Dallas business district. Instead, they have focused on the northern side of the metroplex, including the Telecom Corridor (Hanson, 2003). Both the old and new leaders have focused for the most part on the development of corporate clusters in North Dallas, Plano, Richardson, and other areas north of downtown. The distribution and quality of metropolitan Dallas office space illustrates the point. Table 1 summarizes a few selected Dallas area office space market indicators. According to the Real Estate Center at Texas A&M University (2007), there are 24 submarkets in the metro Dallas office space market. Table 1 describes 6 North Dallas submarkets and the Southeast Dallas submarket. The 6 North Dallas submarkets were selected because they are part of or near the Telecom Corridor. Pearl C. Anderson is located in the Southeast Dallas submarket.

The Southeast Dallas submarket contains about one third of 1% of the total rentable square footage of office space in the Dallas metropolitan market. The six North Dallas submarkets listed in Table 1 (Central Expressway, Preston Center, Upper Tollway/West Plano, Richardson, Plano, and North Dallas Tollway) each have more than 5.7 times the office space of the Southeast Dallas market. In addition, five of the six North Dallas submarkets have more vacant office space than the total rentable space in the Southeast Dallas submarket, and the space is of much higher quality. A major building with 50,000 square feet or more of office space, high-quality amenities and design, and great location is categorized as a Class A facility. No office building in the Southeast Dallas submarket is categorized as Class A (Real Estate Center at Texas A&M University, 2007, p. 45). In contrast, the six North Dallas submarkets have 158 (or 47.4%) of the 333 Class A office buildings in metropolitan Dallas. Much of the remaining Class A office space is located farther north in the Dallas submarkets of Las Colinas, LBJ Extension, DFW Freeport, Coppell, and Frisco.

Pearl C. Anderson is located in a South Dallas community that shares attributes associated with uneven geography of opportunity as described by Kain (1968), Wilson (1987, 1996), Anyon (2005), and Foster-Bey (2006). The community does not have the office space to accommodate and attract the types of industries that reside in the Telecom Corridor. The metropolitan region has affluent job centers to the north, but the Pearl C. Anderson School and its surrounding community are disconnected from the opportunities associated with the clusters of industrial science activity to the north as a result of long-standing investment patterns in the metropolitan real estate market. Consistent with the literature on geography of opportunity, the Dallas Area Rapid Transit rail system does not include connections in Southeast Dallas.[7] In many respects the community is politically and physically isolated. It is clear that the self-help neighborhood problem solving initiated by the Pearl C. Anderson students faces challenges that require a collective regional response and support system.

The Metropolitan St. Louis Case Study

I now turn to the metropolitan St. Louis case study. Heathcott and Murphy (2005) examined large-scale industrial disinvestment in metropolitan St. Louis after World War II. Specifically, they explored three major policy initiatives: urban renewal, high-tech research and development (e.g., biotechnology), and tourism and entertainment. The focus here will be on the first two initiatives. Who were the key actors? In 1953, Raymond Tucker, a Washington University engineering professor, was elected mayor of St. Louis. Tucker was a skilled technocrat with a national reputation associated with successfully abating smokestack pollution in St. Louis (Heathcott & Murphy, 2005). His leadership was central to reindustrialization efforts and to galvanizing key business and civic interests behind urban renewal. Tucker's efforts inspired confidence in local business, civic, and political elites and compelled the support of the city's major corporate leaders, represented chiefly by Civic Progress, Inc.

Civic Progress as an organization was similar to the Dallas Citizens Council, in that its membership consisted exclusively of corporate leadership (Heathcott & Murphy, 2005). In conjunction with local government officials, Civic Progress formed a development regime that advanced redevelopment projects designed to generate economic growth benefiting corporate interests and, in theory, the city at large. The planning research indicated that slum areas such as Mills Creek Valley and Kosciusko generated 6% of the city's property tax revenues while using more than 40% of the city's fire, police, road, health, and sanitation services. This cost–benefit ratio was viewed as unsustainable. According to Heathcott and Murphy, the city government and Civic Progress launched a war on slums, using eminent domain as a major tool. Their effort displaced predominately working-class Black residents of Mills Creek Valley from the city's central core to make room for middle-class residential housing, and—most significant in the long term—land for the expansion of U.S. Highway 40. The expressway connected the downtown area with growing suburban communities and became the lifeline for transporting future knowledge workers in the emerging biotechnology hub. Many of the displaced Black residents

Table 1
Selected Metro Dallas Office Space Indicators, Year End 2006

Submarket	Total Buildings	Total Rentable Square Feet	Total Vacant Square Feet	Vacancy Rate (%)	Net Absorption[a]
Central Expressway	103	12,897,785	2,087,163	15.9	198,000
Preston Center	58	4,633,816	566,023	8.8	(65,000)
Upper Tollway/West Plano	123	16,822,025	2,630,075	14.7	206,000
Richardson	145	13,119,610	2,328,996	17.3	509,000
Plano	93	6,910,845	1,038,823	13.7	(132,000)
North Dallas Tollway	191	21,419,950	3,855,996	16.5	406,000
Southeast Dallas	16	806,991	41,887	5.2	65,000
Dallas total	1,899[b]	216,796,435[b]	40,439,181[b]	17.8[c]	4,531,000

Note. Data are derived from "Real Estate Market Overview 2007: Dallas–Fort Worth–Arlington" (p. 45), Real Estate Center at Texas A&M University, 2007, *http://recenter.tamu.edu/mreports/2007/DallasFWArl.pdf*. Copyright 2007 by Real Estate Center at Texas A&M University. Adapted with permission.
[a]Net change in physical occupancy for direct and sublet space combined.
[b]The sum of the numbers in this column do not equal the total; instead, the total here reflects the sum of all 24 metro Dallas submarkets.
[c]This is the vacancy rate for the 24 metro Dallas submarkets.

moved to the northern sector of the city. In South St. Louis, Kosciusko was a largely working-class White community with a manufacturing base. City planners displaced thousands of residents to make space for industrial plants and commercial firms. In both communities, hundreds of small businesses and religious and community institutions closed their doors or were relocated along with their social networks.

A second, and related, development effort focused on the creation of a metropolitan research corridor. To that end, in the early 1960s local business and political leaders initiated the St. Louis Regional Industrial Development Corporation and the St. Louis Research Council for the purpose of coordinating economic development in the metropolitan region (Heathcott & Murphy, 2005). The goal of these organizations was to advance defense and high-tech industries and university research. The leaders of both groups included many members of Civic Progress, along with the chief executive officers of St. Louis University, Washington University, Monsanto, and McDonnell Aircraft Corporation.

One industry that emerged from the St. Louis regional coalition was biotechnology. Figure 1 provides a visual snapshot of the St. Louis regional plant and medical sciences research and development nodes. The geospatial composition of the research corridor started with downtown institutions of government, finance, and industrial research and development and extended along the east-west axis of U.S. Highway 40, where major university research centers, hospitals, and corporations shaped the physical contours of an emerging biotechnology industry that extends to the west into St. Louis County and St. Charles County.

Are the regional biotechnology companies randomly located? To answer this question, my research team and I applied the nearest neighbor index, a measure of clustering, to the biotechnology companies in metropolitan St. Louis (see Figure 2). The null hypothesis is that the metropolitan St. Louis biotechnology organizations are randomly located (distributed). The method calculated the distance between the site of each biotechnology organization and that of its nearest biotech neighbor.[8] Next, the average of all these nearest neighbor distances was computed. If the average distance is less than the average for a hypothetical random distribution, then the distribution of the metropolitan St. Louis biotechnology organizations is considered clustered. If the average distance is greater than in a hypothetical random distribution, the organizations are considered dispersed. The index is expressed as the ratio of the observed distance divided by the expected distance. The expected distance is based on a hypothetical random distribution with the same number of features covering the same total area. Thus the numerical interpretation of the average nearest neighbor distance index is straightforward. If the index is less than 1, the pattern exhibits clustering. If the index is greater than 1, the pattern trend is toward dispersion. In this case, the average nearest neighbor distance index was equal to .54 with a Z-score of –8.2 ($p < .01$). The null hypothesis is rejected, and the results suggest a statistically significant, high degree of clustering by metropolitan St. Louis biotechnology organizations.

The regional biotechnology clustering is noteworthy in light of the degree of geopolitical fragmentation in metropolitan St. Louis. According to Orfield (2002), metropolitan St. Louis ranks second in geopolitical fragmentation in a ranking of the 25 largest metropolitan areas in the United States. Metropolitan St. Louis consists of 312 local governments (12 counties and 300 municipalities and townships), with 13.8% of the population living in St. Louis City. There are 12.2 local governments per 100,000 residents in the metropolitan region. A high degree of geopolitical fragmentation is a sign that people who can afford housing elsewhere are leaving the central city. This is the case in metropolitan St. Louis. Laslo (2004) reported that during the period between 1950 and 2000, St. Louis City lost an average of 10,172 persons annually. For the first 30 years of that period, St. Louis County was the foremost recipient of the out-migration. More recently, St. Charles County has been the beneficiary, and as a result grew at one of the fastest rates in the nation between 1990 and 2000.

Ironically, large central city income growth has a positive external effect on suburban home value appreciation and income growth (Voith, 1998). Thus the out-migration of high-income

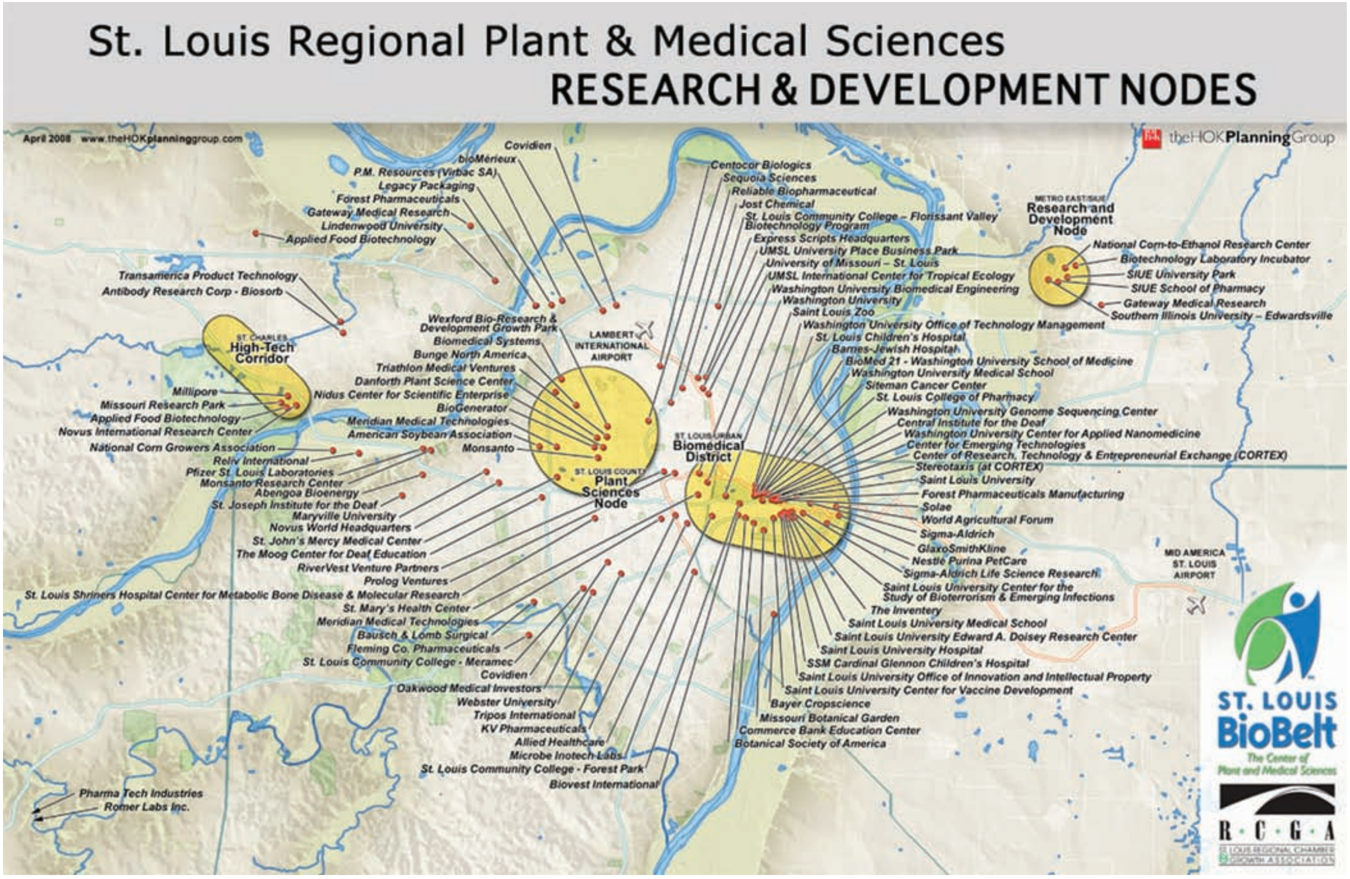

FIGURE 1. *St. Louis regional biotechnology nodes in the plant and medical sciences. This is an illustration of the geographic locations of biotechnology companies and higher education institutions. St. Louis Regional Chamber and Growth Association, http://www.stlrcga.org/x1734.xml, Plant and Medical Sciences Profile. Copyright 2008 by St. Louis Regional Chamber and Growth Association. Reprinted with permission.*

earners from large cities is a potentially troubling trend for both city and suburbs. As Orfield (2002) explains,

> The population explosion in suburban communities over the past several decades has led some commentators to suggest that "the" suburbs have become politically, socially, and economically independent from the central cities—unaffected by the concentrated poverty, aging infrastructure, and high crime that plagues many of the nation's largest cities. . . . Despite growing evidence of their interdependence, many regions become even more fragmented with growth and expansion into new communities. Instead of fostering cooperative planning that benefits the entire region, this fragmentation has made it more difficult for metropolitan regions to address regional problems such as concentrated poverty, social and fiscal disparities, traffic congestion, and urban sprawl. With hundreds of local governments, each making its own land-use and investment decisions, there is little sense of how all the pieces fit together into a comprehensive whole. (pp. 130–131)

One way to better understand the comprehensive whole associated with the geography of opportunity in metropolitan St. Louis is to examine it through the lens of the biotechnology industry rather than by way of a severely fragmented geopolitical governance structure. This approach is supported by the statistically significant clustering of biotechnology organizations in the region and by a related literature that describes how planning for the advancement of industrial science has informed regional development (Heathcott & Murphy, 2005; Tranel, 2004).

We conducted kernel density estimation (KDE) to assist in the visualization of the metropolitan St. Louis biotechnology clusters (see Figure 3). KDE is a method for calculating the density of events as a continuous field (Wang, 2006). It turns discrete point data into a continuous surface of values and thus highlights the spatial patterns of the events. The "events" in this case are biotechnology organizations. The kernel radius for each biotechnology organization was set at 2.8 miles. Four color levels were used to indicate degree of clustering, the darkest indicating the highest degree of clustering. Now it is possible to analyze the region using the four biotechnology clusters as organizational frames of reference rather than the hundreds of municipalities and other governance arrangements in metropolitan St. Louis.

Figure 4 displays rates of unemployment across the four biotechnology clusters. Concentrated high unemployment is clearly present in the cluster labeled St. Louis City Urban Core. High-risk neighborhoods are defined as those reporting an unemployment rate higher than 20%, and the St. Louis City Urban Core cluster's northern sector has a disproportionate number of census block groups classified as high-risk. In addition, a few neighborhoods in southern St. Louis City have employment rates in the high-risk

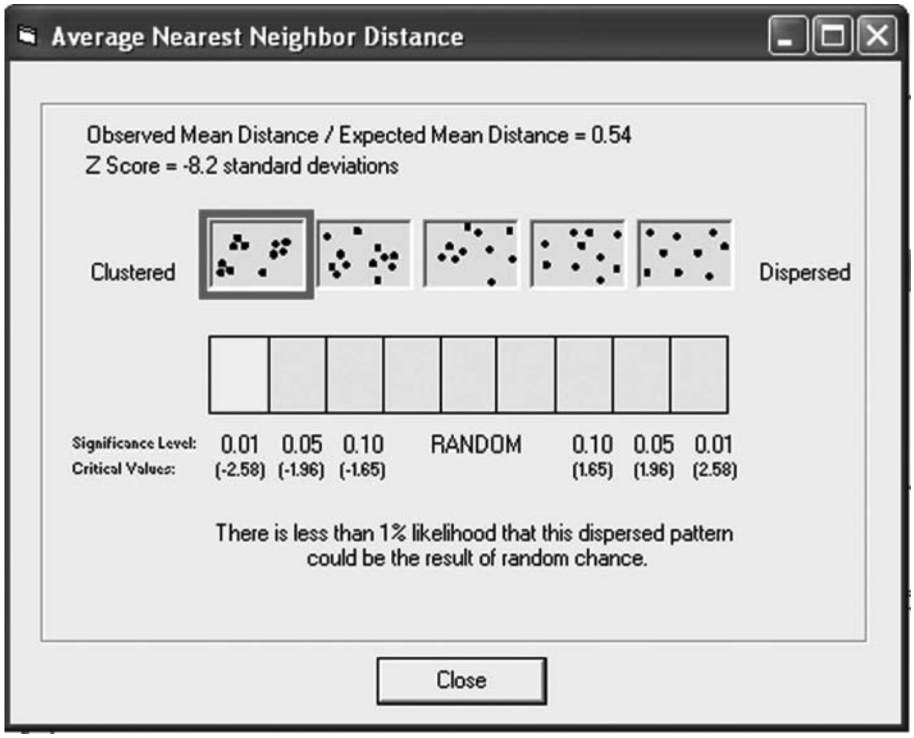

FIGURE 2. *Nearest neighborhood index (NNI). The NNI is computed by finding the distance between each biotech company and the biotech company closest to it, then calculating the average of these distances. The NNI measures how similar this mean distance is to the expected mean distance for a hypothetical random distribution (Mitchell, 2005). ArcInfo 9.1 GIS software from ESRI produced the computation and graphic (www.esri.com).*

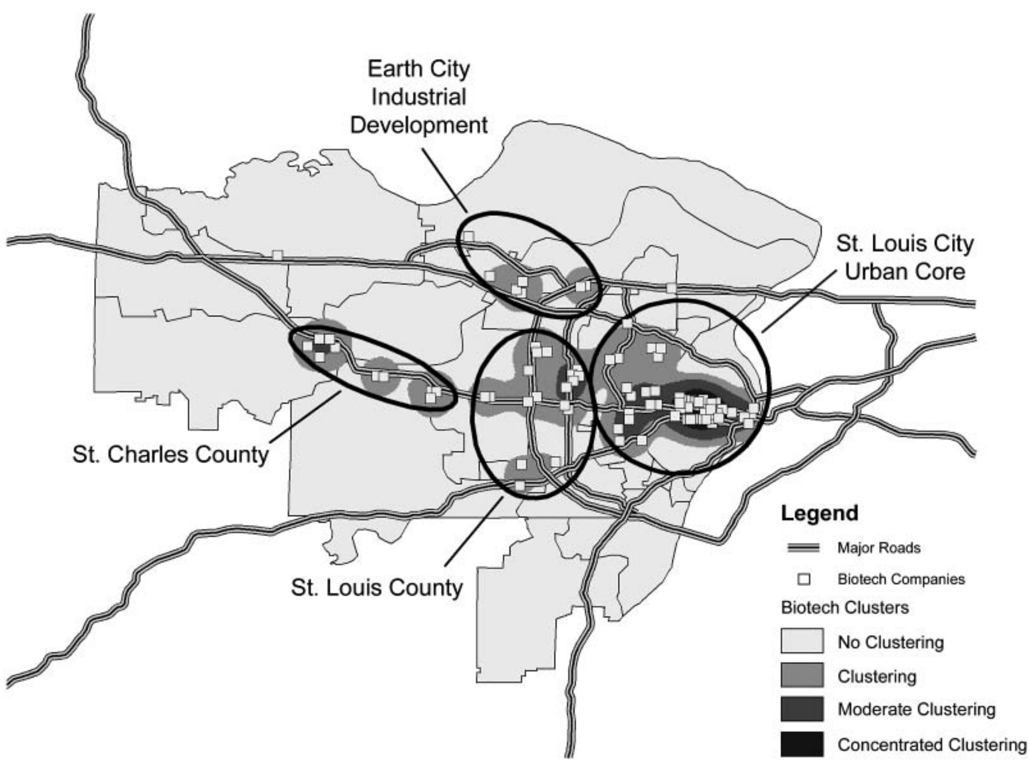

FIGURE 3. *Clustering of biotech companies in the St. Louis region. The map reflects kernel density estimation (KDE) for point features. KDE was used to turn discrete point data into a continuous surface of values that highlight spatial patterns. The kernel radius for each biotech company (point) was set to 2.8 miles. ESRI ArcInfo spatial analysis extension produced the estimation.*

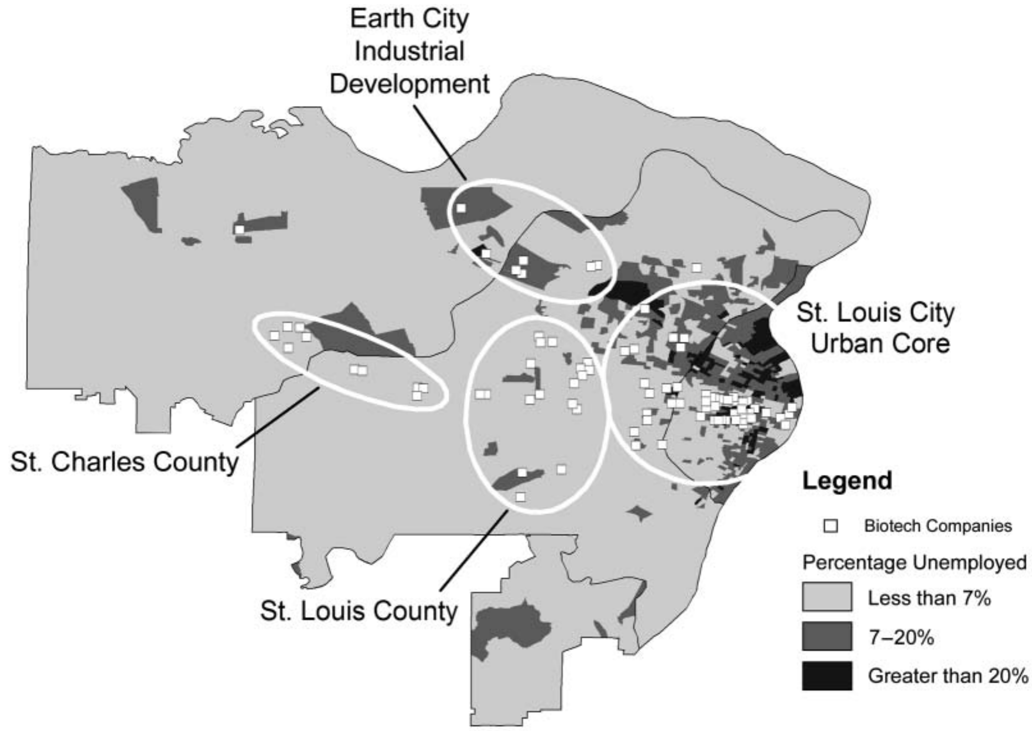

FIGURE 4. *Year 2000 Census block groups showing percentage unemployed. Data are from the 2000 U.S. Census, http://www.census.gov.*

category. The St. Louis County and St. Charles County biotechnology clusters do not have any census block groups in the high-risk category for unemployment rate. The Earth City Industrial Development cluster has a very small number of census block groups classified as high-risk. Portions of northern metropolitan St. Louis that are not part of any biotechnology cluster include a concentrated high-risk neighborhood constellation. This collection of high-risk neighborhoods bridges two biotechnology clusters—St. Louis City Urban Core and Earth City Industrial Development.

Figure 5 displays the percentage of residents 25 years or older with bachelor's degrees in each metropolitan biotechnology cluster. The St. Charles County and St. Louis County clusters have concentrated bachelor's degree attainment greater than 20%. The St. Louis City Urban Core cluster consists largely of census block groups where residents' bachelor's degree attainment is less than 10%. In addition, northern and a few southern neighborhoods have very limited degree attainment rates. The Earth City Industrial Development cluster has census block groups that span all three classifications, with a majority of the census block groups categorized as 10–20% with bachelor's degree attainment. The findings raise a question about who is working in the St. Louis City Urban Core biotechnology cluster. Although nearly 68% of all employees in that cluster commute from surrounding areas, according to the St. Louis Regional Chamber and Growth Association (2007), more than 40% (or 105,207) of employees in the cluster commute from St. Louis County.

Figure 6 shows the percentage of households with incomes in the \$100K–150K range in each metropolitan St. Louis biotechnology cluster. The St. Louis City Urban Core cluster consists largely of census block groups where fewer than 5% of the household incomes are \$100K–150K. This percentage is consistent with the degree attainment finding. The other biotechnology clusters vary with respect to the percentage of census block groups within their boundaries categorized in the \$100K–150K household income range. Figure 6 illustrates that parts of St. Louis County that are outside its biotechnology cluster have the most concentrated census block groups categorized in the household income range of \$100K–150K in the metropolitan region. This location is west of St. Louis City.

Figure 7 illustrates the percentage of students receiving free and reduced-price lunch by biotechnology cluster. All school-related variables are drawn from school district sources rather than census group blocks. The St. Louis City Urban Core cluster has a concentrated number of schools with more than 66% of their children receiving free or reduced-price lunch. The students are educated in schools largely located in northern St. Louis City and a few southern-sector neighborhoods. The other three biotechnology clusters have a large majority of the schools where fewer than 33% of the children are eligible for free or reduced-price lunch.

Figure 8 provides a visual display of the percentage of students proficient or advanced in 10th-grade mathematics on the Missouri 2002 MAP test by cluster. The year 2002 was selected because data for that year are available in both mathematics and science at this grade level. In the St. Louis City Urban Core cluster, the percentage of 10th graders classified at the proficient or advanced level is consistently lower than 10% across schools. Tenth graders in the St. Louis County and St. Charles County clusters were classified at the proficient or advanced level in the 10–41% range. The 10th graders in the Earth City cluster were classified largely as proficient or advanced level at less than 10% or 10–20%.

Figure 9 illustrates the percentage of students proficient or advanced in 10th-grade science on the Missouri 2002 MAP test by cluster. The intent here is to focus on the St. Louis City Urban Core cluster. Fewer than 5% of the 10th graders achieved at a proficient or advanced level in science. This result is a major

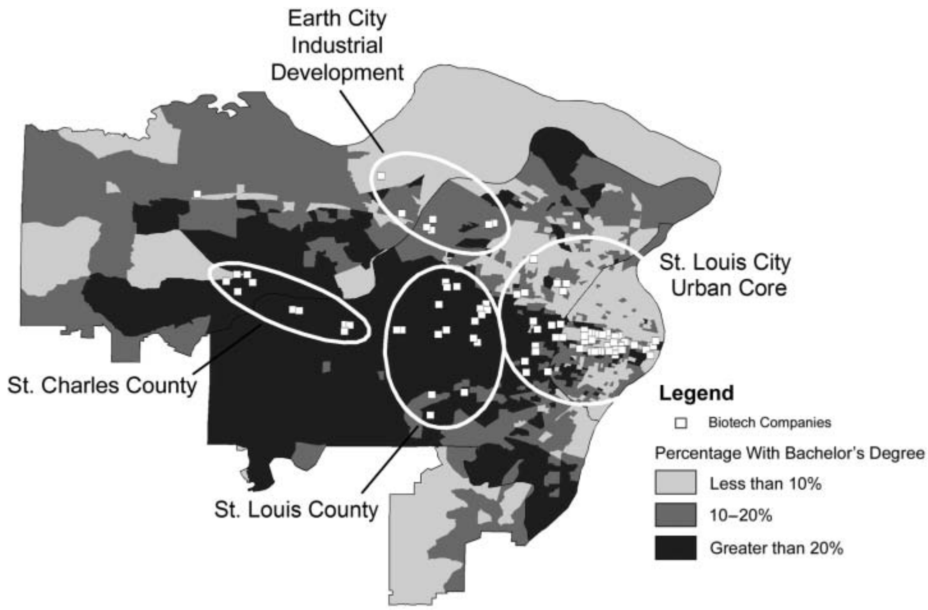

FIGURE 5. *Year 2000 Census block groups showing percentage with bachelor's degrees. Data are from the 2000 U.S. Census, http:// www.census gov.*

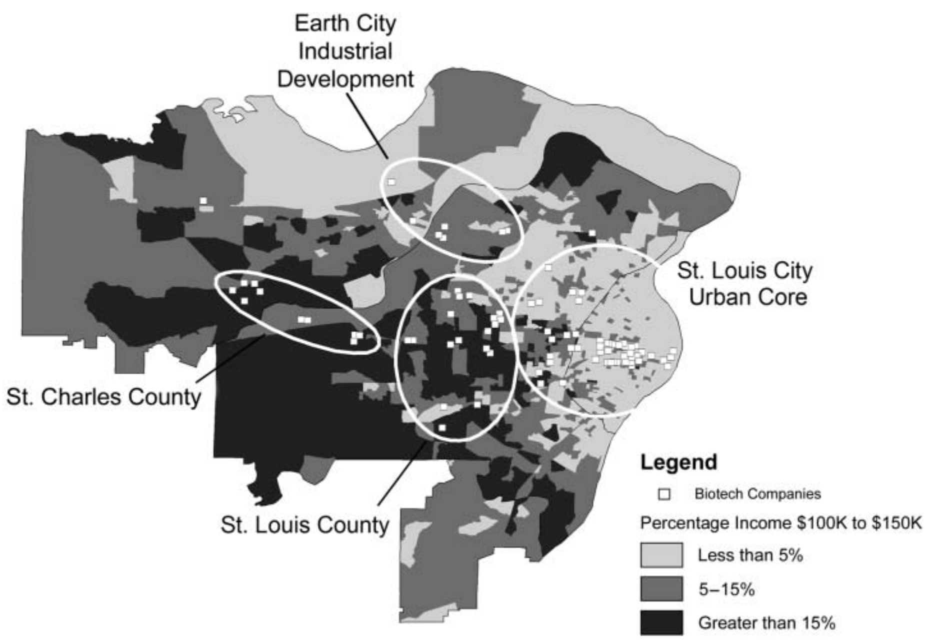

FIGURE 6. *Year 2000 Census block groups showing percentage with household income of $100K–$150K. Data are from the 2000 U.S. Census, http://www.census.gov.*

concern for anyone interested in providing students indigenous to the St. Louis City Urban Core cluster with opportunities to take part in the economic promise related to the local biotechnology research and development effort. These students also need better preparation if they are to engage some day in the technically sophisticated political debates associated with science and the region (e.g., stem cell voting and funding).

The St. Louis biotechnology effort can be summed up succinctly. The four biotech clusters are linked by their proximity to a major east-west highway system. The universities, corporations, and industrial parks that form the biotechnology effort are spatially distributed in a manner that is clustered rather than random. The St. Louis County and St. Charles County clusters have lower unemployment rates and a greater concentration of families earning incomes of $100K–150K than do the St. Louis City Urban Core and Earth City Industrial Development clusters. The St. Louis County residents are positioned to take advantage of employment opportunities in the St. Louis City Urban Core. In fact, a high number of county residents commute to the city for employment. The St. Louis County and St. Charles County clusters

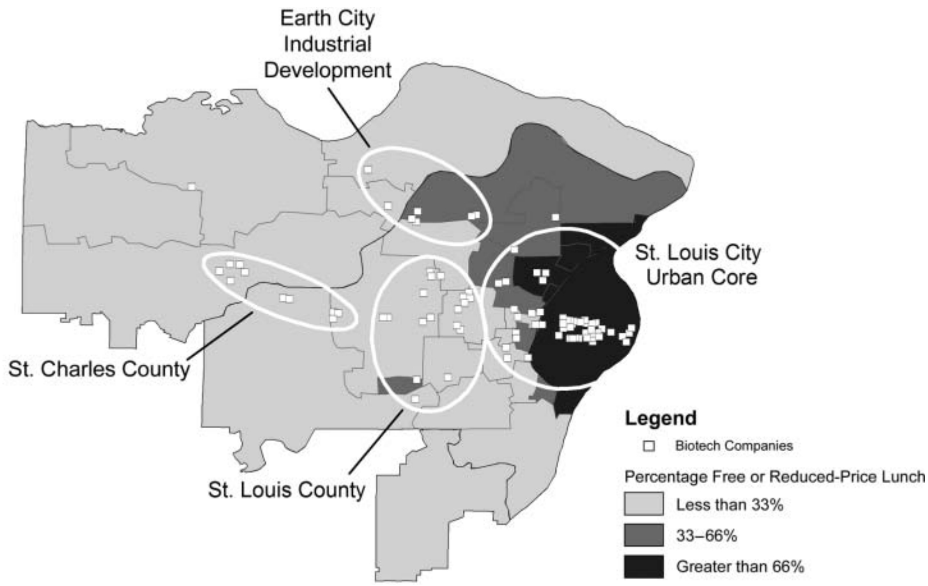

FIGURE 7. *Percentage of students receiving free or reduced-price lunch, by St. Louis area school districts. Data are from the Missouri Department of Elementary and Secondary Education, http://dese.mo.gov/schooldata/.*

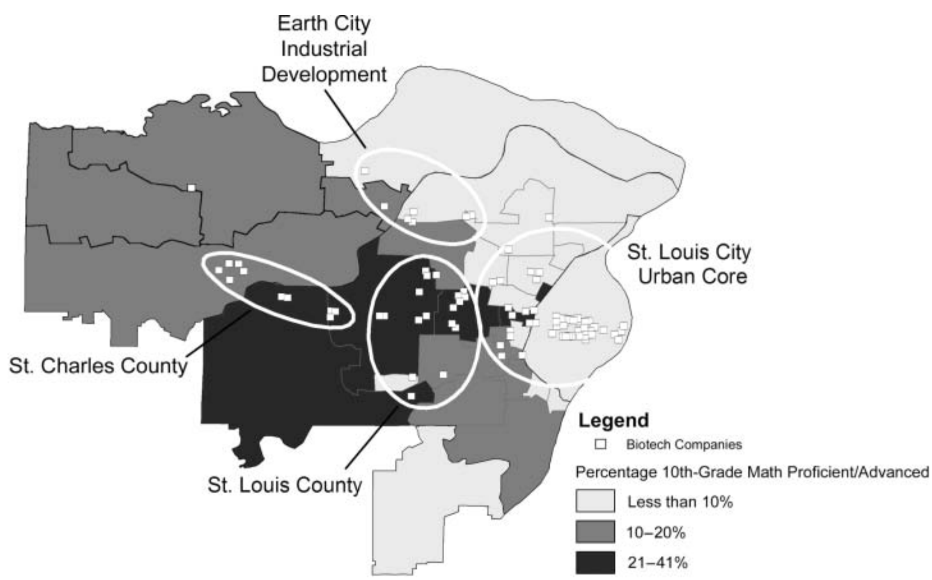

FIGURE 8. *Percentage of students proficient or advanced in 10th-grade math on Missouri 2002 MAP Test. Data are from the Missouri Department of Elementary and Secondary Education, http://dese.mo.gov/schooldata/.*

have greater levels of education attainment and fewer students classified as eligible for free and reduced-price lunch than do the other two clusters. In addition, 10th-grade student performance in science and mathematics was higher there in 2002 than in the other two clusters. Significant unemployment and family poverty exist in northern neighborhoods and a few southern communities in the St. Louis City Urban Core cluster (see also Baybeck & Jones, 2004). These findings strongly suggest that uneven geography of opportunity is present in the metropolitan St. Louis region.

Final Remarks

The Dallas and St. Louis case studies reminded me of a statement from a book titled *The Death and Life of Great American Cities* (1992). The author, the late Jane Jacobs, stated:

> A successful city neighborhood is a place that keeps sufficiently abreast of its problems so it is not destroyed by them. An unsuccessful neighborhood is a place that is overwhelmed by its defects and problems and is progressively more helpless before them. Our cities contain all degrees of success and failure. But on the whole we Americans are poor at handling city neighborhoods as can be seen by the long accumulations of failures in our great gray belts on the one hand, and by the Turfs of rebuilt city on the other hand. (p. 112)

Jacobs contended that it is extremely important to bear in mind the nature and size of a community when making planning decisions. She commented that towns, suburbs, and even small cities are different organisms from large cities. One argument in the book is that attempting to understand big cities in terms of

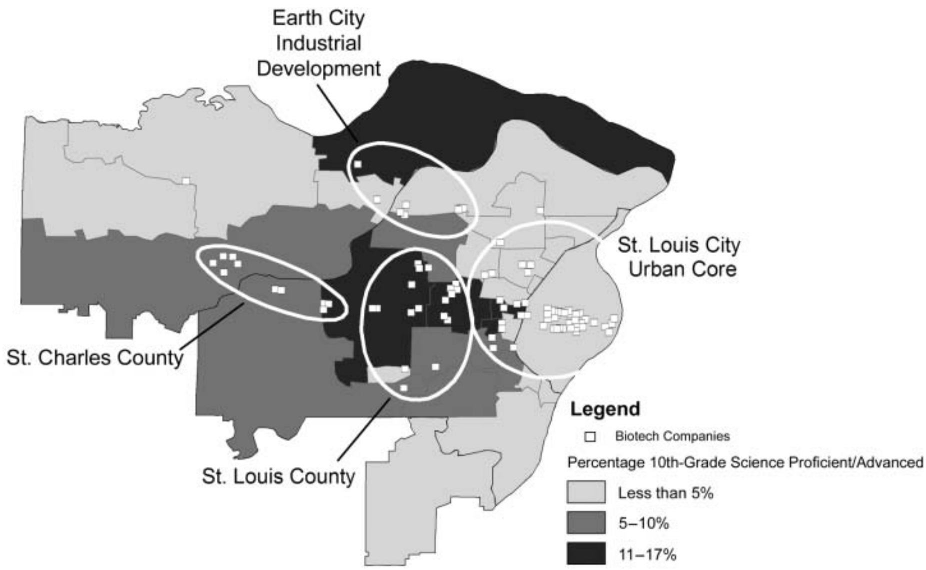

FIGURE 9. *Science proficiency. Percentage of students proficient or advanced in 10th-grade science on Missouri 2002 MAP Test. Data are from the Missouri Department of Elementary and Secondary Education, http://dese.mo.gov/schooldata/.*

towns—real or imagined—can only lead to problematic planning and development. There are at least two lessons to be learned from Jacobs's book in light of the Dallas and St. Louis case studies.

The first lesson is straightforward. To seek an understanding of the strengths and problems in our communities is an important civic function. This is true in big and small cities, towns, suburbs, and rural communities. As education researchers, we have a civic responsibility to provide relevant and rigorous research that informs how we come to understand the interdependencies of the social, cultural, and economic institutions in our communities and how they relate to education processes and outcomes. I believe every major metropolitan region in the United States should have an organized, independent research collaboration engaged in this type of work. Stone, Henig, Jones, and Pierannunzi (2001) contended that collective cognition matters when the goal is to take on the task of problem solving in school reform. If universities and other research institutions develop and/or study theories of action that include meaningful cross-disciplinary, research-based deliberations involving other relevant community leaders, then I predict that the future of the research enterprise in education will be very different from that in other fields of social science. Although the models for doing this kind of analytical work can vary, the Consortium on Chicago School Research at the University of Chicago is an exemplar in terms of education research. The distinguishing features of the organization include a comprehensive data archive, geographic focus on the city of Chicago, engagement with a range of stakeholders, diverse methodologies and numerous researchers, and a clear commitment to communicating research findings to many publics.[9] The University of Chicago model is focused on the education enterprise in the city. Yet more is required. Lipman (2002) and Pattillo (2007) provide insightful analyses of the city of Chicago that suggest the need to link research on human development in schools with the study of development regimes. I see this interdisciplinary approach as an essential part of a model research enterprise. Linking research on human development (in and outside school settings) and development regimes has the potential to enhance ecological validity while contributing to the geography-of-opportunity literature.

In addition, I envision a metropolitan research organization that takes seriously the interdependent relationships among municipalities in a region (e.g., Briggs, 2005; Goetz, Chapple, & Lukermann, 2005; Rusk, 2003; Voith, 1998; Wells & Crain, 1997). This will require a comprehensive understanding of regional conditions. Orfield (2002) argued that to achieve the foundational knowledge base required for regional coalition building, we must

> understand the local fiscal equity questions, whether they center on improving school aid or the potential to improve or create an aid system to cities and suburbs. Understand also the local issues surrounding growth management and transportation/transit planning. Measure road spending and land use. (p. 181)

A second and related lesson is that scholarship in the field of education should recognize the importance of geography in the research process where appropriate. The research literatures of business and economics describe the role of industrial clusters and networks in communities (Gordon & McCann, 2000; Heathcott & Murphy, 2005; Snyder, Johns, Mongan, & Utaski, 2003; Sorenson, 2003). The sociology literature includes important discussions of social structures including the spatial dimensions of opportunity in communities (Brown & Lauder, 2006; Pattillo, 2007; Wilson, 1996). The political science literature is attentive to public–private partnerships as well as to community, city, state, and federal governance (Brunori, 2003; Judd & Swanstrom, 2008). The public health literature examines the geography of medical resources, risk factors, and disease (Airhihenbuwa & Liburd, 2006; Douglas, Esmundo, & Bloom, 2000). The literatures of psychology and the developmental sciences examine child and adolescent development and cognitive outcomes in a variety of contexts including the community setting (Lee, 2008; Spencer, 2008; Spencer, Dupree, Cunningham,

Harpalani, & Muñoz-Miller, 2003). A growing literature describes the role of higher education as leading the technical advancement of local industrial science (Building Engineering and Science Talent, 2006; Duca & Yücel, 2002; Fisher & Koch, 2004; Greater Dallas Chamber of Commerce, 2006; Paugh & Lafrance, 1997; Snyder et al., 2003). Now is the time to increase support for research that links the study of industrial development with the full range of developmental sciences. I believe this intellectual merger will further advance the relevance and influence of education research.

The stakes are high. An uneven geography of opportunity, left unaddressed, generally grows (Rusk, 2003). This concern was articulated by a member of the Pearl C. Anderson problem-solving team. The student's words and deeds are worthy of a civic crown. She was determined to save the lives of others in the battle for a decent education and healthy living conditions. The student—I will call her Jordan—wrote:

1. Listen my children and you shall hear about
how we live and what we fear
Other kids don't feel the shame, kids in our hood
fear violence and gangs.
Hobos, prostitutes surrounded by trash
with drunks, broken bottles and dealers making cash.

The people say "We're so cute:,
try to pat our heads and say "Now shoo."
They say they'll help,
Then give us the boot.
They tell us something, but don't tell us the truth.
Would you like living around this abuse?

2. So listen my children and you shall hear
about how we live and what we fear.
Other kids don't know the shame.
Kids in the hood fear violence and gangs.

There is only one way to come to school,
That's past 13 liquor stores, and that's not cool.
When we walk past the stores, what do we see?
Boarded up buildings and drunks who are obscene.

We're a team, we work together,
To move those stores, now and forever.
Community helpers want to picket,
Hey the MOVE team does it the legal way.

We've worked hard to get where we're at,
But we're not quite finished yet.
We want future kids to grow up safe,
Not knowing the abuse that we had to take.

3. We don't care what people say,
We're not going to quit till those stores
are out of our way,
Stores, out of our way
Stores, out of our way
Stores, out of our way

(Jordan's poem mailed by S. Mason, May 25, 1994)

NOTES

A number of individuals and organizations supported the development of the research described in this article. I have benefited from research support provided by Marilyn Broughton, Debra Barco, Carol Camp-Yeakey, Brian Cohen, Jamel Donner, Mark Hogrebe, Edward Macias, Margaret Spellman, Kimberly Tate, Cameron Tate, Quentin Tate, Daryl Tate, Martha Yager, and Li Zou. A special thank you to my colleagues at CFC Technologies and the St. Louis Center for Inquiry in Science Teaching and Learning (CISTL). CISTL is supported by the National Science Foundation's Centers for Learning and Teaching program. CISTL is a collaboration among higher education institutions (Washington University in St. Louis, St. Louis Community College, and the University of Missouri–St. Louis), cultural science institutions (Missouri Botanical Garden, Saint Louis Zoo, and St. Louis Science Center), and school districts (Kirkwood, Maplewood-Richmond Heights, Riverview Gardens, St. Louis Public, and University City). This article is based on work supported by the National Science Foundation under Award No. ESI-0227619. Any opinions, findings, and conclusions or recommendations expressed here are those of the author and do not necessarily reflect the views of the National Science Foundation.

[1]The phrase *geography of opportunity* is borrowed from Briggs (2005).

[2]See, for example, the Missouri Stem Cell Constitutional Amendment 2 initiative (retrieved March 16, 2008, from http://www.sos.mo.gov/elections/2006petitions/ppStemCell.asp).

[3]Numerous societies and organizations have assumed the mission of meeting this demand, including the American Evaluation Association (http://www.eval.org/). The history of the American Educational Research Association is also linked to the evaluation demand in society (Urban, 1998).

[4]For additional discussion of this theorem and related mathematics (e.g., Fourier Transformations), see Harris and Stocker (1998). Eves (1953/1983) provides a historical perspective on the mathematics of Fourier.

[5]The name of this case study participant, a teacher, has been changed for purposes of identity protection.

[6]The video was designed to examine the neighborhood context. Specifically, it was produced to examine the physical contours of the neighborhoods surrounding the school sites. The production was designed to exclude any students and educators. In addition, community members were not a focus of the production.

[7]To view a map of the Dallas Area Rapid Transit rail system, visit http://www.dart.org/maps/printrailmap.asp (retrieved March 8, 2008).

[8]This description of the nearest neighbor index is a paraphrased version of the text to be found at http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=How%20Average%20Nearest%20Neighbor%20Distance%20(Spatial%20Statistics)%20works (retrieved March 17, 2008).

[9]For more information about the portfolio of scholarship produced by this organization, visit http://ccsr.uchicago.edu/content/publications.php (retrieved August 29, 2008).

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